Experimental Safety Plan (ESP) Instructions

General Instructions

An Experiment Safety Plan (ESP) is required for every experiment conducted and performed by students in the WERC Design Contest. The purpose of the ESP is to assure the safety of all by identifying the safest possible methods to conduct an experiment. By signing below the individual(s) conducting the experiment, College of Engineering Safety Specialist (COE Safety), and the faculty advisor acknowledge responsibility for the following requirements.

1) *Appropriate Personal Protective Equipment (PPE) **must always** be worn while in the lab (as described in the ESP). **The minimum required PPE to enter a research/teaching lab is (1) long pants, (2) closed toe shoes, (3) lab coat or long sleeve shirt, and (4) safety glasses with side shields.***
2) *For safety reasons, no researcher is permitted to work alone in the lab at any time.*
3) *ESP approval occurs in two phases.*
    a. *Phase I is the preparation of a written safety plan includes an evaluation by COE Safety (and if appropriate by EH&S) to establish controls of hazardous operations, avoid the purchase of inappropriate supplies, and establish expected waste(s) streams. Upon approval of the written plan, by email from COE Safety, the team has been approved to bring their experiments, equipment and necessary chemicals to the WERC Design Contest.*
    b. *Phase II approval will occur onsite at the event and requires evaluation of the assembled experiment, and a "dry run" of the experimental procedure. Upon approval, the team may acquire control sample solutions and begin operation of their experiments.*

Experimental Scope:

Provide a concise description of the laboratory experiment to be undertaken.

1. *Explain why the work is being performed, the goal(s) of the experimental program*
    a. *If this is an update/revision of previous ESP describe all changes*
2. *Provide the stoichiometry of any chemical reactions and their heats of reaction*
3. *Demonstrate the inherent thermal safety of your experiment through calculation or through the use of accelerating rate calorimetry data.* https://chme.nmsu.edu/research/ehs/experimental-safety-plan-esp/esp-energetics-calculation/ *)*
4. *Include a complete list of all chemicals (reactants and products) involved in the work.*
5. *Include a complete list of all equipment (e.g. autoclave, centrifuge, pump, heat bath etc.) involved in this work*
6. *Include a timeline for this experiment including setup, sample runtime(s)and teardown and explain how any after-hours running experiments will be addressed (i.e. will the equipment operate autonomously or monitored remotely or monitored by someone onsite and if so for how long or other scenarios)*

Drawing of Experimental Layout including P&ID

Provide a detailed drawing of the experiment including P&ID's showing all flow of inputs and outputs for equipment and system. Note that this is required for all ESPs

Normal Operation, Startup and Shut-down Procedures:

*Provide a **step-wise** procedure that describes **in detail** how the work will be performed. The procedure should begin and end with the equipment in the normal idle (inoperative) state.*

*Include a statement of the required PPE **at the beginning** of the procedure, and at every location in the procedure where the PPE requirements change.*

Include details of how you will meet the required elements of your chosen task (e.g. run time, run rate, sample rate etc.)

Indicate where hazardous feedstock chemicals will be stored, how they will be transported to the location of the experimental work, how they will be transferred from storage vial into the experimental apparatus, and how they will be returned to storage.

Take into account those items for which you indicate "yes" on the WERC Lab Hazard Assessment Checklist (See the Attachment Tab).

***E*mergency Shutdown Procedures:**

*Provide a **step-wise** procedure that describes how the equipment will be brought to a safe state in the event of an emergency. Consider emergency situations such as loss of power, fire in your equipment, fire in the surrounding lab area, etc. The description should include a detailed explanation of how to attend to potential medical emergencies that may result*

Waste Management Procedure:

Prepare a Waste Management Procedure that provides the exact nature and estimated volumes of all wastes to be generated in performing these experiments. NMSU will provide containers and forms to be filled out by the researcher for proper disposal of materials. (See the Attachment Tab for examples of the NMSU Waste Tracking Form, NMSU Waste Sticker and photos of containers.)

Hazard Identification and Mitigation:

Identify and discuss ALL HIGH hazards associated with the experiment. Use the WERC Lab Hazard Assessment Checklist as a guide (See the Attachment Tab).

The analysis must consider

- *all sources of energy (electric, chemical, hydraulics, mechanical, compressed gases),*
- *extreme conditions of pressure or temperature (from flame or steam to cryogenics),*
- *chemical use and storage,*
- *housekeeping,*
- *fire potential*
- *biological hazards*
- *When in doubt about whether something represents a HIGH HAZARD, ask COE Safety for a determination*

The discussion must include:

1. *Description of the HIGH hazard;*
2. *Operational and engineering controls that will be used (based on identified industry best-practices used in addressing this safety hazard);*
3. *Required PPE (beyond minimum) when this HIGH hazard is present; and*
4. *Special training (beyond minimum) that is necessary.*

Other Equipment Needs:

Provide a list and details of any equipment you require that will not, or cannot, be shipped to the event. We have several items available for use and can make them available, but you have to tell us what you need. Examples include scales, balances, electrical test meters, hand tools, secondary containment vessels (e.g. kiddie wading pool), easels, stands, brackets, clamps etc.

Safety Data Sheets

Provide SDS documents for all chemicals used at the event including household and consumer products